MASTER IN MANAGEMENT PROFESSIONAL FOCUS IN BUSINESS ANALYSIS & INTEGRATION

The Determinants of Sustainable Mutual Fund Performance

Mont, Olivier

Award date:
2021

Awarding institution:
University of Namur

The Determinants of Sustainable Mutual Fund Performance

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Mémoire présenté
en vue de l'obtention du titre de
Master 120 en sciences de gestion, à finalité spécialisée
en Business Analysis & Integration

ANNEE ACADEMIQUE 2020-2021

Acknowledgments

I would like to express my gratitude to my supervisor, Prof. Dr. Jean-Yves Gnabo, who guided me throughout this research, for his time and his valuable advices.

I wish to acknowledge the help provided by Camille Baily for her time and the construction of the database used in this study.

Then, I would like to thank Prof. Dr. Béreau as she developed in me a strong interest for sustainable finance.

Finally, I would also like to extend my special thanks to my parents for reviewing my thesis and for providing deep insights into the research.

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Abstract

Recent years have seen many enthusiastic investors towards SR (socially responsible) mutual funds (US SIF, 2016). In that regard, the literature on sustainable investing has grown rapidly over the past 40 years. The principal purpose of academics has been to identify performance differences between SR and non-SR mutual funds. However, we are seeing more and more investors interested in SR investing not because they want higher returns, but because they want to "put their money where their mouth is". In this context, very few have studied the determinants of performance of sustainable mutual funds on their own. In this paper we aim to tackle this question to provide concrete features to investors willing to invest sustainably which should provide them with both high risk-adjusted returns and high "ethical returns". We suggest that larger sustainable mutual funds, with low expenses and management fees, and with no or low front-end and back-end loads perform better, on average, all else equal. To issue these evidences, we use data on more than 2.000 US equity mutual funds from 2012 to 2018. With these data, we compare the determinants of performance of SRI and non-SRI mutual funds. We also test for false discoveries and for potential subperiod biases.

1. Introduction

The purpose of this paper is to give an overview of the determinants of performance of sustainable mutual funds (or SRI). We evaluate fund performance using a survivorship-free dataset that consists of more than 2.000 US active equity mutual funds from 2012 to 2018. We use the Carhart net 4-factor model to measure the risk-adjusted performance. Our overall results suggest, among others, that larger sustainable mutual funds perform better than smaller ones, and that passively managed sustainable funds outperform their actively managed peers.

To the best of our knowledge, few papers study the relationship between the performance of sustainable mutual funds and their characteristics. We assess sustainable fund performance using seven characteristics: size, age, expenses, turnover, management fees, loads, and flows.

This work is useful as, as outlined by (Das, Ruf, Chatterjee, & Sunder, 2018), "very little research has been conducted on the determinants of performance and fund flows among sustainable funds. Given the recent growth in these funds, there is a need to explore the characteristics of such funds that explain the risk-adjusted performance" within the sustainably mutual fund industry.

(Renneboog, Ter Horst, & Zhang, 2008a), and (Bollen, 2007) works on sustainable mutual funds focus primarily on comparing the performance of sustainable and conventional mutual (or non-SRI) funds. They argue that sustainable mutual funds perform better than conventional funds because they invest in companies that demonstrate corporate social responsibility and transparency of their operations. It is expected that these companies are likely to be better managed and hence, generate better risk-adjusted performance. However, very little research

has been conducted on the determinants of performance and fund flows among sustainable mutual funds. Given the recent growth in the sustainable mutual fund industry, there is a need to explore characteristics of sustainable funds that explain their risk-adjusted performance within the mutual fund universe. They recall that previous research finds no difference in risk-adjusted performance between sustainable and conventional mutual funds. These studies include (Hamilton, Jo, & Statman, 1993), (Statman, 2000), (Gil-Bazo & Ruiz-Verdu, 2009), (Renneboog, Ter Horst, & Zhang, 2008a), (Rodriguez, 2010), and (Shank, Manullang, & Hill, 2005).

The development of sustainable funds over the two or three latest decades is undisputable. SRI not only developed but showed a higher resilience when facing adverse circumstances. The last report of the (Global Sustainable Investment Alliance, 2018) indicates that global SRI reached an amount of US$ 30.7 trillion in 2018 in its five main markets (Europe, United States, Canada, Australia and New Zealand, and Japan), increasing by 34% from 2016 to 2018.

The dynamic of the SRI market is clearly highlighted in a paper written by (Hartzmark & Sussman, 2019). They demonstrate the positive value of sustainability from the point of view of the mutual US fund investors taken collectively. Further, although sustainability is a difficult concept to apprehend, they conclude that mutual fund investors treat sustainability in a positive way, so that more money is allocated to sustainable funds and less money is allocated to conventional ones.

SRI not only developed at a high rate, but also seem to be relatively resilient in adverse circumstances. In this respect (Social Investment Forum (SIF), 2001) observes that during the 2001 stock market downturn, there was a 94% drop in the money inflows into all US mutual funds, whereas the drop was only 54% for SRI funds. The SRI relative resilience is treated by (Ait El Mekki, 2020). He notes that the 2008 financial crisis has highlighted a growing preference for responsible investment and consideration of ethical decisions in finance. Since the subprime crisis, many institutional and private investors have been seeking ways to integrate their social and financial interests. As a result, a significant proportion of investors have adopted SRI principles.

Regarding sustainable investments (Renneboog, Ter Horst, & Zhang, 2008a) find that in recent years, corporate social responsibility has become a focal point of policymakers and the public, who demand that corporations assume more responsibility towards society, environment, and stakeholders. The demand for SRI is linked to the investors' aim to promote socially and environmentally sound corporate behaviour. (Kiymaz, 2019) makes the same analysis: the awareness for the social issues influencing living conditions has increased the popularity of social and ethical investments during the last few decades. Social investing reflects, among others, investors' concerns on human right abuses, environmental deprivation and mistreatment of workers.

Among the elements explaining the development of the SRI market (Hartzmark & Sussman, 2019) make 3 assumptions. The first is that there exists an institutional pressure either to hold high sustainability stocks and not to hold low sustainability stocks. The second is that investors rationally view sustainability as a signal for higher returns. Thirdly, some investors want to hold

high sustainability funds and avoid low ones due to either an irrational belief that there is a positive correlation between future returns and sustainability or due to nonpecuniary motives (such as altruism, climate change, or social norms). Referring to the latest hypothesis, they find evidence that sustainability characteristics impact expectations of future performance and lead investors to make choices based on nonpecuniary motivations. They observe that sustainable funds benefit from a higher inflow of money and the contrary for conventional funds, which indicates that a large portion of the market views sustainability as a positive attribute. This confirms that investors expect sustainable funds to perform relatively better and/or have a relatively lower risk.

Notwithstanding the above-mentioned factors explaining the popularity of SRI funds, the determinants of SRI performance remain largely unexplored.

As shown notably by (Ferreira, Miguel, Keswani, & Ramos, 2013), investors are increasingly interested in mutual fund selection, demanding detailed mutual fund information advice. (Pangestuti, Wahyudi, & Robiyanto, 2017) draw a similar conclusion: mutual funds have become one of the strategic investment activities especially for small investors who do not have time and expertise in calculating their investment risk and return.

Concerning the factors explaining the performance of SRI funds, (Silviana, Widyatama , & Hamdani, 2018) also stress the lack of studies on the issue of the factors explaining sustainable mutual fund performance, so that this issue could be investigated more deeply. This point is additionally illustrated by (Tang, Wang, & Xu, 2012). They deem that mutual fund performance is affected by various features of mutual funds and, among them, fund size is widely considered to be an important issue. In their paper, they regret that this question is nearly not treated for SRI.

The lack of academic works on the factors explaining sustainable fund performance contrasts with a large amount of research on mutual funds in general. Indeed, as underlined notably by (Ferreira et al. 2013) many authors have tried to explain the performance of mutual funds. Several fund characteristics have been analysed as potential determinants of future fund performance including fund size, age, fees, expenses, loads, turnover, flows, and returns (see, for example (Jensen, 1966), (Grinblatt & Titman, 1989b), (Ippolito, 1989), (Hendricks, Patel, & Zeckhauser, 1993), (Brown & Goetzmann, 1995), (Gruber, 1996), (Carhart, 1997), (Chevalier & Ellison, 1999), (Sirri & Tufano, 2002), and (Zheng, 1999).

Overall, there is a large and growing interest for sustainable investing. This trend cannot be explained by a significant difference in their relative performance but rather by other motives (ethical beliefs, nonpecuniary factors, etc.). Therefore, it is relevant to examine what are the determinants of performance of sustainable mutual funds. This is the principal purpose of this thesis.

First, we explain the development of sustainable investing. Then, we review the existing literature on the characteristics driving the performance of both sustainable and conventional mutual funds to identify the main determinants of performance. Then, armed with these characteristics, we use a dataset of more than 2.000 US equity mutual funds to run regression

analysis to find the determinants of performance of SRI mutual funds. Finally, we check for the robustness of our results with a false discoveries test and a subperiod analysis.

1.1 History of Sustainable Investing

This section addresses the evolution of the sustainable finance industry. It is based on the works of (Renneboog, Ter Horst, & Zhang, 2008b), (Fulton, Kahn, & Sharples, 2012), and (AitElMekki, 2020).

Sustainable investing is based on various concepts. Some go back to ancient times. For instance, religions prohibited investments considered as not being ethical, as highlighted by (Renneboog, Ter Horst, & Zhang, 2008b): "Judaism required to use money ethically ; during the Middle Ages, Catholicism restricted loans and investments on the basis of principles included in the Old Testament and usury was prohibited; rejection of profits from weapons or slavery by the Quakers in the 17th century; ban on the production of alcohol, tobacco and weapons in the 1920s by the Methodist Church; prohibition based on the teaching of the Koran of investments in companies involved in pork production, gambling and interest-based financial institutions; etc.".

However, the first "true" SRI appeared between the two world wars. The Pioneer Fund of Boston (nowadays Amundi), was created in 1928 by a certain Philip Carret. This Fund still exists and manages assets amounting to $1.3 trillion at the end of 2018, employing about 5000 persons. The popularity of SRI, however, took off in the 1960s, with the growing awareness of social consequences of investments. The first "modern" SRI mutual fund, the Pax World Fund, was created in 1971 by investors opposed to the Vietnam War. Such a fund excluded activities linked to weapons production or military and nuclear arms. It is still in activity today, but with a rather modest scale (about 50 employees). In the 1980s, with the focus on the apartheid prevailing in South Africa, mutual funds were urged not to incorporate South African and western firms with South African subsidiaries into their investment portfolios. Environmental disasters in the 1980s and the emergence of a more ethical consumerism from the early 1990s also impacted investing behaviour.

Thus, from the early 1960s, SRI developed gradually. More recently, corporate governance became another focal point for SRI investors, this being exacerbated by the crisis of 2001 and the subprime crisis of 2008. As a result, the development of the SRI market went hand in hand with the growing importance of environmental, social and governance (ESG) factors into investment decisions. Therefore, SRI became a fully-fledged element of an investment strategy, as it could allow to maximise financial return while taking due account of these factors.

The importance of sustainable investment has also been recognised by the international community. So, in 2003, a report published by the United Nations Environmental Programme (United Nations Environment Programme, 2003) underlined the impact of environmental, social and corporate governance issues on the long-term shareholders' value and, three years later, the concept of "responsible investment" was coined.

As illustrated above, nowadays investment decisions are not exclusively motivated by economics (the traditional approach of the neoclassical homo economicus) but are rather based on a combination of factors (return, liquidity and risk, but also sustainability). In this framework, sustainable investing appears as a large concept referring to SRI, investment based on ESG factors as well as responsible investing. There does not exist any precise dividing line between all these concepts.

The growing interest for SRI triggered the exceptional growth of these investments. The figures mentioned in various papers on SRI show the phenomenal growing trend of this market during the two or three latest decades. In the US, this market increased by 1200 % between 1995 and 2005, to reach $2.3 trillion at the end of this period, the SRI market representing in 2005 about 10 % of total assets managed in this country. The same trend was observed in Europe where the SRI market amounted to the equivalent of $1.4 trillion (between 10 and 15 % of the European funds under management). Although the SRI mutual funds available to retail investors were much smaller ($179 billion in 2005 in the US and $30 billion in Europe), its growth was also exponential (Renneboog, Ter Horst, & Zhang, 2008b).

Such a rapid growth was also observed afterwards, notably following the increased focus on issues like global warming and as a consequence of the financial crisis of 2008.

While the number of SRI assets under management in the main markets in the world was somewhat less than $4 trillion in 2005, its size was more than 5 times higher in 2018, attaining nearly $20 trillion. These figures mentioned in the (Global Sustainable Investment Alliance, 2018) which are the most recent ones when writing this work, highlight the continued development of the SRI market. The global SRI reached $12 trillion in the US (compared with $2.3 trillion for the managed SRI assets in 2005), $14.1 trillion in Europe ($1.4 trillion for the managed SRI assets in 2005), $1.7 trillion in Canada ($0.055 trillion for the managed SRI assets in 2005) and $0.7 trillion in Australia and New Zealand ($0.006 trillion for the Australian managed SRI assets in 2005) and $2.2 trillion in Japan. In addition, the GSIA report shows that a large share (57 %) of the global amount of SRI is linked to ESG criteria (AitElMekki, 2020).

1.2 Terminology of Sustainable Investing

As highlighted here above in the historic overview of SRI and more precisely by (AitElMekki, 2020), there is a great heterogeneity in the literature regarding the terminology referring to sustainable investing. (Fulton, Kahn, & Sharples, 2012) define all the terms related to sustainable investing: a summary table can be found in the appendix.

The SRI investments are frequently defined in opposition to “conventional investment” and there exists a plurality of terms to explain the reasoning behind SRI (sustainable, ethical, environmental, green, social, alternative, governance, etc.) and a consensus has not yet emerged on the term(s) to be focused on.

Nonetheless, “socially responsible (SR) mutual fund” seems to be largely used, as shown by (Renneboog, Ter Horst, & Zhang, 2008a), (Rathner, 2013), (AitElMekki, 2020), (Capelle-

Blancard & Monjon, 2014), (Humphrey & Lee, 2011), (Kiymaz, 2019), (Das, Ruf, Chatterjee, & Sunder, 2018), (Gil-bazo, Ruiz-verdu, & Santos, 2010), (Gnabo & Vanhomwegen, 2020), (Kempf & Peer, 2008), (Rield & Smeets, 2017), and (Nosfinger & Varma, 2014) who use either SR or SRI terms. However, (Bauer, Derwall, & Otten, 2007) and (Bauer, Otten, & Koedijk, 2005) use the terms "ethical mutual fund", and (Hartzmark & Sussman, 2019) employ the term "sustainable mutual fund".

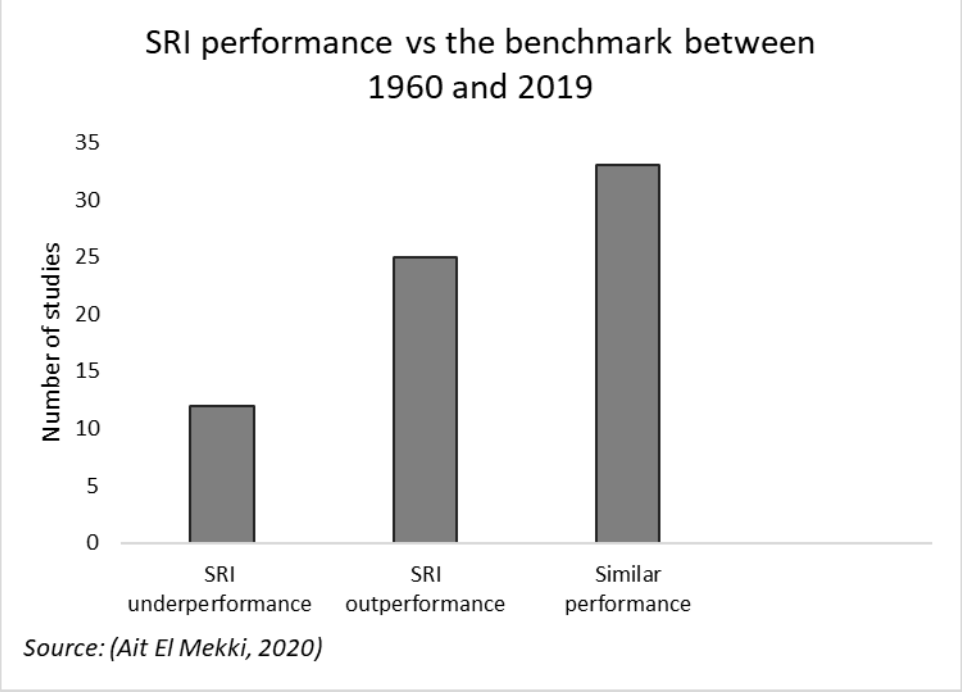
This justifies that, in this paper, we opt to use the terms "SRI" and "sustainable" mutual funds distinguishing them from "non-SRI" or "conventional" mutual funds.

2. Literature Review

In this section we examine the academic literature on the characteristics of performance respectively of conventional and sustainable mutual funds. Finally, we elaborate the hypotheses underlying this study.

2.1 Performance of Conventional and Sustainable Funds

One factor that could explain the development of SRI is performance. It has received a special attention in the literature and, in this respect, (Ait El Mekki, 2020) observes that during the past forty years a large number of studies have been written on the comparison between SRI and conventional fund performance. His results are summarised in the table and the figure hereafter.



Conclusions made by (Ait El Mekki, 2020) are confirmed by (Fulton, Kahn, & Sharples, 2012) who recall that investigations into potential SRI fund performance currently yields mixed results among academics and the investor community on the whole. They observe that the "market does not price social responsibility characteristics" as also asserted by (Derwall, Koedijk, & Ter Horst, 2011). Most current SRI funds tend indeed to "reflect a hybrid of negative and positive social responsibility screens", with an outperformance of "sin stocks" and an outperformance of sustainable firms yielding neutral or mixed results. An example of sin stocks outperforming is underlined by (Hong & Kacperczyck, 2009), who find that these stocks have "higher expected returns than otherwise comparable stocks, consistent with them being neglected by norm-constrained investors and facing greater litigation risk heightened by social norms." This study analyses public companies involved in producing alcohol, tobacco and gambling and finds that "sin stocks are less held by norm-constrained institutions such as pension funds as compared to mutual or hedge funds that are natural arbitrageurs, and they receive less coverage from analysts than do stocks of otherwise comparable characteristics." This demonstrates how the market can have dissonant results, pricing sin stocks higher due to greater expected returns from a fundamental perspective, while pricing sustainable firms based on very different sets of sustainability attributes.

In addition, comparisons between the returns of SRI and conventional funds are influenced by managerial skills and timing activities, as well as the additional expenses associated with SRI transactions (Statman & Glushkov, 2009).

No matter the difficulty to evaluate fund performance, literature review of research studying the performance of SRI funds relative to conventional funds reflect this difficulty.

Firstly, there are academic studies pointing SRI outperformance vis-à-vis non-SRI mutual funds.

For (Statman, Socially responsible mutual funds, 2000), who investigates the performance of SRI funds in the US between 1990 and 1998, SRI funds perform better than their counterparts, but that difference is not statistically different.

(Weber, Mansfeld, & Schirrmann, 2010) describe the outperformance of SRI funds in their analysis of 151 SRI funds relative to the MSCI Index[1] from 2001 to mid-2009, concluding that SRI funds yield returns above average.

(Nosfinger & Varma, 2014) find evidence of sustainable funds outperforming conventional funds during crisis periods.

(Hartzmark & Sussman, 2019) find a strong and positive relation between the Morningstar ESG ratings and the expected future performance, and a strong and negative relation between these ratings and expected riskiness.

Secondly, some academic studies on SRI fund performance conclude to neutral or mitigated results.

[1] It is a stock market index which is widely used as a benchmark.

(Hamilton, Jo, & Statman, 1993), conclude that SRI performed better and … poorer than conventional funds. They investigate the performance of 32 SRI funds and 320 randomly selected non-SRI funds in the US for the period 1981-1990 and find that old SRI funds overperform conventional funds, and young SRI funds underperform.

(Goldreyer & Diltz , 1999), find that SRI equity funds underperform non-SRI funds, but the difference is statistically not dissimilar.

(Bauer, Otten, & Koedijk, 2005) study an international sample of 103 ethical mutual funds and document that ethical funds do not underperform conventional funds.

(Bauer, Derwall, & Otten, 2007) disagree with the claim that "imposing ethical constraints leads to weaker investment performance, finding that no significant difference exists between the returns of sustainable and conventional mutual funds.

(Cortez, Silva, & Areal, 2009) analyse 46 funds spread over European and American markets during the 1996-2008 period. They also suggest that the "majority of global socially responsible funds' performance is neutral compared to both conventional and socially responsible benchmarks."

(Gil-bazo, Ruiz-verdu, & Santos, 2010) find that SRI funds underperform the market, but not to a significant degree.

(Biehl & Hoepner, 2011) look at 50 UK funds over a 12 years period (1998-2010) and conclude that neither a linear nor curvilinear relationship exists between ethical and financial performance; therefore, an increase in social investment does not necessarily reduce fund returns, as many investors might fear.

(Amenc & Le Sourd, 2013), analysing 69 French SRI funds from January 2002 to December 2009, find that a large majority of funds (93%) register a performance equivalent to that of conventional funds.

(Capelle-Blancard & Monjon, 2014) offer a more mitigated image of sustainability from an investor's viewpoint. Their conclusion based on the results of 55 academic papers that study several hundred funds (mainly equity mutual funds), over the period 1963-2008 in almost 20 countries underline that in 46 of the 55 papers there is no performance differences between SRI and non-SRI funds. They refer to the portfolio theory of diversification for explaining this finding: an investor aims certainly at the higher possible return while avoiding an excessive level of volatility, the optimal portfolio being the portfolio which cannot be diversified further. In principle, as emphasised by the financial theory, it is not possible to beat the market and SRI funds could not be an exception to the rule. Incidentally this also means that as long as SRI funds are sufficiently diversified, they normally could not perform poorly nor better than the market.

(Gnabo & Vanhomwegen, 2020), contest the conventional wisdom, recalled above, following which investment performance should be adversely affected by imposing ethical criteria on portfolio composition, as that restriction should worsen portfolio diversification along with

portfolio efficiency (Markowitz, 1952). They find that SRI and non-SRI funds perform on par if they have an investment universe large enough.

Thirdly, a group of works find that the average SRI fund perform poorer that the average conventional mutual fund.

(Adler & Kritzman, 2008), (El Ghoul & Karoui, 2017), (Candelon, Hasse, & Lajaunie, 2018) indeed find evidence of underperformance of SRI funds. (Renneboog, Ter Horst, & Zhang, 2008a) advance the "the fact that SRI apply screens may reduce their performance. For instance, excluding part of the stock market (firms producing tobacco, oil, etc.) may negatively influence the risk-return trade-offs of SRI funds. In this logic, SRI funds are expected to generate a weaker financial performance than conventional funds for they underinvest in or exclude financially attractive investment opportunities."

In summary, the vast majority of the research body do not find any evidence of statistically significant differences between SRI and non-SRI funds. These authors find that SRI and non-SRI funds perform on par. But some also conclude that the size of a fund is crucial in this respect. For (Rathner, 2013), from a theoretical perspective, there are three different hypotheses about performance comparisons of SRI and conventional funds. The "underperformance hypothesis" suggests that SRI funds generate weaker financial performance than conventional funds. The main reason for the underperformance can be seen in the fact that "the implementation of SRI screens limits the full diversification potential which "may shift the mean-variance frontier towards less favourable risk-return trade-offs than those of conventional portfolios". The "outperformance-hypothesis" claims superior returns of SRI funds. An outperformance of SRI funds may occur if the SRI screening process generates value-relevant information which would not be available to fund managers otherwise. This additional information may help fund managers to select securities with higher risk-adjusted returns. The "no-effect-hypothesis" suggests that there is no significant difference between the returns of SRI and conventional funds. This hypothesis proposes that the SRI screening process has neither a positive nor a negative influence on the financial performance. The reasons for the contradictory evidence are largely unexplored. One possibility is that primary study characteristics influence the results. It is reasonable to assume that, for instance, the chosen sample period may influence the results. This could be true if, for example, the performance of the SRI fund industry during the early period of its development was worse than in later periods (possibly due to learning effects).

2.2 Determinants of Performance of Conventional Mutual Funds

The academic literature about the determinants of performance of conventional mutual funds is extensive and shows mixed results. For every characteristic, there are academics who find evidence of a positive effect on performance, others who find evidence of a negative effect, and others who find that there is no effect at all. In this context, we present a comprehensive review of the literature on the characteristics that drive performance within mutual funds.

2.2.1 Size

The most recent literature studying the influence of fund size on fund performance tends to highlight a quadratic relationship between size and performance. However, there is no clear consensus as to the effect of size. These differences might be due to sample, time period or survivorship bias differences.

Regarding a potential quadratic-concave relationship (i.e., inverted U-shape) between fund size and fund performance, the literature assumes that, up to a certain level, a size increase leads to a better performance because of economies of scale. But, past that certain level, a fund will see diseconomies of scale because it has exploited all the good investment opportunities. This hypothesis implies that there is an optimal fund size which maximises the performance. (Bodson, Cavenaile, & Sougné, 2011) state that the optimal US equity mutual fund size rangers between $36.66 million and $324.93 million. Other studies ((Nopphon, 2014), (Indro, Jiang, Hu, & Lee, 1999) and (Tang, Wang, & Xu, 2012)) also find evidence of a quadratic relationship between size and performance.

Then, some argue that there is a negative relation between fund size and performance. The (Green & Berk, 2004) model supposes that funds behave in a decreasing return to scale environment. Thus, an increase in the size, on average, would damage future performance. Smaller funds have many advantages over larger ones. Firstly, they can focus on a handful of investment opportunities and are less limited in their investment universe. Moreover, small funds do not suffer from liquidity constraints. Indeed, they do not attract the attention of other market participants when they trade, because their trading volume is much lower than those of larger funds, and thus do not, or to a lesser extent, endure a price impact cost in comparison with larger funds[2]. Another advantage of small funds is that they do not suffer from organisational diseconomies: larger funds have higher costs due to inefficiencies within their hierarchies and organisational structures. For instance, large organisations are particularly slow to process soft information[3] and to implement new investment strategies (for example, it might demand a lot of efforts from a manager to see its investment ideas applied in a large fund). In this regard, smaller funds might have less research expense because they use more efficient and soft information prior to investing, in comparison with larger funds which need more research and hard information before investing. (Becker & Vaughan, 2001) state that when the size of a fund increases, "the portfolio manager loses flexibility: it becomes harder to switch in and out positions. Executing a desired trade will take longer and create adverse market impact price moves. The resulting reduction in the speed and nature of the portfolio adjustment will ultimately impair fund performance." Smaller funds have another advantage as they have not yet saturated their investment opportunities[4]. In addition to that, they can invest in more liquid stocks, which is not necessarily the case for larger funds, which have no other choice but to invest in less liquid stocks because they have saturated their liquid investment opportunities.

[2] In other words, smaller funds can buy or sell stocks without altering stock prices.
[3] "Information that cannot be verified directly by anyone other than the agent who produces it." (Chen, Huang, Hong, & Kubik, 2004)
[4] Finding "diamonds in the rough" (i.e., lesser-known firms) in which to invest may become an issue as the fund size increases.

Then (Williamson, 1988) and (Wang & Nanda, 2011) state that large funds face more bureaucracy costs and coordination costs. Finally, (Ferreira et al. 2013) support the hypothesis that smaller US mutual funds perform better than their larger counterparts, and that solo-managed funds perform better than team-managed funds. This is also the case for (Grinblatt & Titman, 1989), (Sawicki & Finn, 2002), (Chen, Huang, Hong, & Kubik, 2004), (Pollet & Wilson, 2008), (Yan, 2008), (Bessler, Kryzanowski, Kurmann, & Lueckoff, 2016), of (Prather, Bertin, & Henker, 2004), (Perold & Salomon, 1991), (Lobão & Gomes, 2015), and (Tang, Wang, & Xu, 2012) in the US mutual funds and for (Dahlquist, Engström, & Söderlind, 2000) within the Swedish mutual fund market and for (Jones, 2009) within hedge funds.

Other academics find that size is positively related to performance. For instance, (Ciccotello & Grant, 1996) support the hypothesis that successful funds grow their size rapidly because they are able to capture additional cash from investors at a rapid rate. (Otten & Bams, 2002) find that European mutual fund performance is positively impacted by the size because there are still room for economies of scale within the European market (while it might not be the case within the US market). (Amenc & Martellini, 2004) observe that smaller hedge funds perform less well than larger hedge funds, on average. Overall, the advantages of larger mutual funds are numerous. Firstly, they can diffuse their fixed costs over a larger asset base. Secondly, they have more financial resources to invest in equity research, thus having relatively more information than smaller funds (Brennan & Hughes, 1991). Thirdly, large funds have access to a broader set of investment opportunities as they have more means to find these opportunities. Fourthly, they are more diversified which leads to a significantly lower risk (Indro et al. 1999). Fifthly, they can hire more managers to find more investment opportunities. Sixthly, size can be seen as a signal of quality during market downturns (Das et al. 2018). Finally, large funds see their relative transaction fees decrease as the transaction size increase. This is in line with (Zera & Madura, 2001) who find that larger funds have less expense percentages. Moreover, larger funds can have relatively higher expenses with regard to their size, in comparison to smaller funds, which ultimately allows to capture more money and yield higher returns.

Finally, other studies state that there is no evidence of a relation between fund size and performance. This is the case of (Droms & Walker, 1996) who find no relation between fund size and returns, and with (Low, 2012), (See & Jusoh, 2012), (Clark, 2003), and (Gusni & Faisal, 2018).

Nonetheless, the impact of size may also depend on the investment style of a fund. For instance, (Ciccotello & Grant, 1996) find that more aggressive funds have a smaller optimal size, contrary to less aggressive ones. This is due to the fact that size increase is easier to manage in the less aggressive funds as the use of the additional cash is generally invested in better-known firms with more available information, implying less research expense.

Overview of the relationship between fund size and fund performance:

Positive relation	(Amenc & Martellini, 2004), (Ciccotello C. S., 1996), (Otten & Bams, 2002), (Green & Berk, 2004), (Friend & Blume, 1970), (Das et al. 2018), (Kiymaz, 2019)
Negative relation	(Chen, Huang, Hong, & Kubik, 2004), (Yan, 2008), (Grinblatt & Titman, 1989), (Dahlquist, Engström, & Söderlind, 2000), (Sawicki & Finn, 2002), (Pollet & Wilson, 2008), (Jones, 2009), (Ferreira et al. 2013), (Bessler et al. 2016), (Lobão & Gomes, 2015)
Quadratic relation	(Indro et al. 1999), (Bodson, Cavenaile, & Sougné, 2011), (Tang, Wang, & Xu, 2012), (Nopphon, 2014)
No relation	(Clark, 2003), (Droms & Walker, 1996), (Prather, Bertin, & Henker, 2004), (Low, 2012), (See & Jusoh, 2012)

2.2.2 Age

Regarding the influence of fund age on performance, (Gregory, Matatko, & Luther, 1997) and (Lobão & Gomes, 2015) show evidence that older funds perform better than younger ones because the latter are negatively affected by a learning period, and by the fact that they have higher costs, such as marketing costs, during their start-up period. Furthermore, younger funds tend to be smaller and, as a result, bear greater market risk because they are less diversified.

Contrary to these findings, one could argue that less mature funds are more agile and have to reach a high performance in order to survive past the start-up period. In line with this hypothesis, (Otten & Bams, 2002), and (See & Jusoh, 2012), respectively studying European and Thai mutual funds, find that younger funds perform better than older ones.

Finally, (Peterson, Petranico, Riepe, & Xu, 2001), (Low, 2012), (Prather, Bertin, & Henker, 2004), (Ferreira et al. 2013) and (Chen et al. 2004) find no evidence that the age of a fund has an impact on its performance. Thus, (Prather, Bertin, & Henker, 2004) make the hypothesis that older funds, which have accomplished past successes, will not necessarily reiterate these successes in the future.

Overview of the relationship between fund age and fund performance:

Positive relation	(Gregory, Matatko, & Luther, 1997), (Blake & Timmermann, 1998), (Bauer, Otten, & Koedijk, 2005), (Lobão & Gomes, 2015)
Negative relation	(Otten & Bams, 2002), (See & Jusoh, 2012)
No relation	(Peterson et al. 2001), (Chen et al. 2004), (Prather, Bertin, & Henker, 2004), (Low, 2012), (Ferreira et al. 2013)

2.2.3 Flows

Regarding the influence of money in and out flows on mutual fund performance, there is a hypothesis of a smart money effect which suggests that investors are able to identify the best-performing funds. However, there are some academics who find no relation or a negative one between flows and performance.

The smart money effect states that "newly invested money in an equity mutual fund is able to forecast short-term future performance" and "those funds that receive more money subsequently perform significantly better than those that lose money" (Zheng, 1999). The smart money effect is supposed to come from fund-specific information which is used by investors to make their decision. In other words, it means that investors have good fund picking ability as they have a tendency to invest in funds with future good performance. Another hypothesis for the smart money effect is that investors withdraw their money from past poor performers to direct it towards past good performers, in the belief that this will yield higher returns. This is supported by (Gruber, 1996), (Barber, Zheng, & Odean, 2004), and (Elton, Gruber, & Busse, 2004). Nonetheless, (Barber, Zheng, & Odean, 2004) show that this effect is effective during a limited time period (about one quarter) and that funds which experience higher inflows do not beat the market. In the same vein, (Lynch & Musto, 2003) show evidence that "flows are less sensitive to past performance when past performance is relatively poor". According to them, this is due to the fact that long-term poor-performing funds are less likely to change their investment strategies or their managers, than short-term poor-performing funds. Moreover, (Gruber, 1996) states that only the "sophisticated clientele" directs its money towards top performers, while the "disadvantaged clientele" directs its money based on either advertising (this is the case of "unsophisticated investors"), fixed plan (this is the case of institutional investors such as pension funds), tax issues (this is the case of investors who have no interest to withdraw their money because of capital gains taxes). In addition, (Sirri & Tufano, 2002) find that funds which expend more money in advertising their recent good performance receive more inflows, relative to funds with good recent performance which do not advertise. In conclusion, the smart money effect seems to be limited as investors unquestioningly track past good performers which do not yield positive future abnormal performance. This evidence is supported by (Cooper, Gulen, & Rau, 2005) who find that 332 funds which changed their names to reflect current 'hot styles' but without changing their investment strategies resulted in higher inflows without yielding better performance.

(Ippolito, 1989), (Lobão & Gomes, 2015), and (Grinblatt & Titman, 1989) find evidence of a positive relationship between fund flows and fund performance. Moreover, (Zheng, 1999) find evidence of a relationship between size, flow and performance as new money flows into smaller funds yield a higher return than in larger funds.

On the contrary, (Ferreira et al. 2013), (Chen et al. 2004) and (Dahlquist, Engström, & Söderlind, 2000) find no evidence, in the US and in Sweden, that there is a relationship between flows and performance.

And finally, (Bessler et al. 2016) find a negative relationship between flows and performance.

Overview of the relationship between fund flows and fund performance:

Positive relation	(Ippolito, 1989), (Grinblatt & Titman, 1989), (Zheng, 1999), (Gruber, 1996), (Lynch & Musto, 2003)
Negative relation	(Bessler et al. 2016)
No relation	(Chen et al. 2004), (Dahlquist, Engström, & Söderlind, 2000), (Ferreira et al. 2013)

2.2.4 Net Expense Ratio (NER)

Regarding expenses, a large number of studies state that expenses harm performance. This is supported by (Dahlquist, Engström, & Söderlind, 2000) and (Golec, 1996) who explain that, ceteris paribus, as expenses are deducted from the fund's income, it can only weaken performance as it ultimately reduces the shareholders' cash flows. However, some academics argue that an effective use of expenses should enhance performance. But, (Prather, Bertin, & Henker, 2004) argue that expenses are not used effectively as they find that expenses decrease performance. This is in line with (Sharpe, 1966), (Dahlquist, Engström, & Söderlind, 2000), (Otten & Bams, 2002), (Elton, 1993), (Carhart, 1997), (Malkiel B. G., 1996), (Golec, 1996), (Gil-Bazo & Ruiz-Verdu, 2009), and (Indro et al. 1999) who find that funds with lower expenses perform better than their peers. These overall results might suggest that mutual funds overinvest in information. Secondly, (Bogle, 1998) states that passively managed funds have lower expenses and outperform actively managed ones, because the latter have to bear more costs (for instance, operating or research costs).

(Gruber, 1996) states that expenses are statistically not higher for top-performing funds.

Then, some academics, such as (Ippolito, 1989), find that risk-adjusted returns are not related to expense ratio for US funds because higher expenses should earn higher returns which should be enough to cover the higher charges. This is in line with (Ferreira et al. 2013) and (Chen et al. 2004) who do not find any link between expenses and performance in US equity mutual funds, and with (Low, 2012) within the Malaysian market.

Finally, some studies find evidence of a positive relation between NER and performance. This is the case of (Droms & Walker, 1996), (Lobão & Gomes, 2015), (See & Jusoh, 2012), and (Wermers, 2000) who find that higher expenses should yield higher returns because these expenses are used in equity analysis in order to promote new investment strategies which should earn higher performance.

Overview of the relationship between fund expenses and fund performance:

Positive relation	(Droms & Walker, 1996), (Wermers, 2000), (See & Jusoh, 2012), (Lobão & Gomes, 2015)
Negative relation	(Gruber, 1996), (Golec, 1996), (Carhart, 1997), (Dahlquist, Engström, & Söderlind, 2000), (Otten & Bams, 2002), (Gil-Bazo & Ruiz-Verdu, 2009), (Prather, Bertin, & Henker, 2004), (Elton, 1993), (Malkiel B. G., 1996), (Indro et al. 1999), (Bogle, 1998), (Sharpe, 1966)
No relation	(Ferreira et al. 2013), (Low, 2012), (Chen et al. 2004), (Ippolito, 1989)

2.2.5 Loads

The objective of front-end loads, when one purchases shares of a fund, or back-end loads, when one sells shares of a fund, serve to diminish redemption so that investors are dissuaded to withdraw their money from the fund (Chordia, 1996). Most of the research has shown that loads reduce redemption but there is no consensus as to the effect on performance.

One could argue that loads, as they reduce redemption, allow funds to enter in riskier investment strategies which are more volatile and which do not yield higher risk-adjusted performance. This is in line with (Chen et al. 2004), (Ferreira et al. 2013), and (Droms & Walker, 1996) who do not find any evidence of a relation between loads and performance.

Then, (Carhart, 1997) and (Pollet & Wilson, 2008) find evidence of a negative relation between loads and fund performance. In the same line, (Dellva & Olson, 1998) explain that funds with loads yield lower risk-adjusted returns.

Finally, (Hooks, 1996) states that funds which have low loads perform better than funds with no loads.

Overview of the relationship between fund loads and fund performance:

Positive relation	(Hooks, 1996)
Negative relation	(Carhart, 1997), (Pollet & Wilson, 2008), (Dellva & Olson, 1998)
No relation	(Chen et al. 2004), (Ferreira et al. 2013), (Droms & Walker, 1996)

2.2.6 Management Fees

According to the human capital theory (Becker G. , 1964), skilled managers (i.e., with greater human capital, such as intelligence) should earn higher risk-adjusted returns and receive higher compensation. However, there is no consensus as if skilled mutual fund managers can yield higher returns than their peers.

(Golec, 1996) makes the hypothesis that management fees should be negatively related to performance as they represent a cost which ultimately reduces shareholders' cash flows, all else equal. This is in line with (Lobão & Gomes, 2015) who find that in the EU, Switzerland, and Norway there exists a negative relationship between fees and performance, and it is in line with (Sharpe, 1966), and (Jensen, 1966) who find a negative relationship between fees and mutual fund performance. Thus, following (Carhart, 1997) and (Pollet & Wilson, 2008), funds which charge higher fees will yield smaller returns in addition to the fact that investors will have to support the fees. Nevertheless, (Prather, Bertin, & Henker, 2004) argue that if management fees support a certain managerial expertise, then it should positively impact performance. But they find that, in reality, it is not the case and that, perhaps, investors overpay fund managers in regard to their results.

On the other hand, (Golec, 1996) finds a robust and positive link between management fees and performance. He argues that this result may be due to the fact that higher fees are paid to skilled managers. This is also the case of the Portuguese equity mutual fund market, where (Lobão & Gomes, 2015) discover that funds which charge larger fees produce higher performance. They make the argument, based on findings from (Ippolito, 1989), that "funds which produce higher returns are able to charge higher fees because those returns more than compensate investors for the higher fees they have to pay". Finally, (Chevalier & Ellison, 1999) support that skilled managers yield higher risk-adjusted returns.

Yet, (Ferreira et al. 2013) and (Chen et al. 2004) find no evidence of a relation between management fees and performance.

Overview of the relationship between fund management fees and fund performance:

Positive relation	(Chordia, 1996), (Golec, 1996), (Lobão & Gomes, 2015), (Ippolito, 1989), (Chevalier & Ellison, 1999)
Negative relation	(Lobão & Gomes, 2015), (Carhart, 1997), (Pollet & Wilson, 2008), (Sharpe, 1966), (Jensen, 1966), (Prather, Bertin, & Henker, 2004)
No relation	(Ferreira et al. 2013), (Chen et al. 2004)

2.2.7 Turnover

Turnover sometimes serves as a proxy to assess whether a fund is actively or passively managed. Overall, turnover implies expenses due to transaction costs and bid-ask spreads. Once again, there is no clear-cut answer as to the effect of portfolio turnover on fund performance.

On the one hand, some authors find that turnover is negatively related to mutual fund performance. Some state that passively managed funds outperform actively managed funds. It is the case of (Bogle, 1998) who argues that it is because passively managed funds have fewer expenses. Others, such as (Elton, 1993), state that turnover implies a certain cost which ultimately neutralise potential profits. (Lobão & Gomes, 2015), in line with (Carhart, 1997), (Indro et al. 1999), and (Malkiel B. G., 1996), also find evidence of a negative relation within

Portuguese and international equity mutual funds arguing that active management does not yield higher returns.

On the other hand, several academics support the hypothesis that portfolio turnover is positively related to fund performance. For instance, (See & Jusoh, 2012) argue that funds managers who trade more stocks are believed to be more skilled and agile because they are able to adjust their investment strategies to markets movements. (Lobão & Gomes, 2015) show evidence of a positive relationship within the US equity mutual fund market. It is confirmed by (Wermers, 2000), (Grinblatt & Titman, 1989), (Friend & Blume, 1970), and (Dahlquist, Engström, & Söderlind, 2000), which seems to indicate that some managers are able to yield higher returns because of their strategies (for instance, they can find underpriced stocks) and their skills. Then, (Ippolito, 1989) states that there might exists a positive relationship only if the returns created thanks to the turnover are enough to cover their costs.

Finally, some authors find no evidence of a relationship between turnover and performance. This is the case of (See & Jusoh, 2012), (Droms & Walker, 1996), (Ippolito, 1989), (Golec, 1996), (Dahlquist, Engström, & Söderlind, 2000), (Low, 2012), and (Prather, Bertin, & Henker, 2004).

Overview of the relationship between fund turnover and fund performance:

Positive relation	(Grinblatt & Titman, 1989), (Lobão & Gomes, 2015), (Wermers, 2000), (Friend & Blume, 1970), (Dahlquist, Engström, & Söderlind, 2000), (Ippolito, 1989)
Negative relation	(Elton, 1993), (Lobão & Gomes, 2015), (Carhart, 1997), (Indro et al. 1999), (Malkiel B. G., 1996)
No relation	(See & Jusoh, 2012), (Droms & Walker, 1996), (Ippolito, 1989), (Golec, 1996), (Dahlquist, Engström, & Söderlind, 2000), (Prather, Bertin, & Henker, 2004), (Low, 2012)

2.3 Determinants of Performance of Sustainable Mutual Funds

The literature on the characteristics of performance of sustainable mutual funds is rather poor in comparison with the extensive literature on conventional mutual funds. Moreover, no unambiguous conclusion can be drawn from the literature addressing the performance of SRI funds or treating the relative performance of these funds vis-à-vis the conventional ones.

Concerning the impact of fund age on performance, (Bauer, Otten, & Koedijk, 2005) provide insight into the "learning curve" of ethical mutual funds as newly launched funds do not perform as well as older funds, which have finally caught up with their conventional peers. In the same vein, (Hamilton, Jo, & Statman, 1993) investigate the performance of 32 SRI funds and 320 randomly selected non-SRI funds in the US for the period 1981-1990 and find that old SRI funds overperform conventional funds, and young SRI funds underperform. This is in line with (Renneboog, Ter Horst, & Zhang, 2008a) who find that age is negatively related to sustainable fund performance but not to conventional fund performance.

Concerning flows into funds or out of funds, there seems to be no major differences between SRI and conventional funds. However, flows out of SRI funds seem to be less sensitive to negative events, so that these types of investments could be more resilient to crises.

In this respect, (Renneboog, Ter Horst, & Zhang , 2005) find evidence that investors in both conventional and sustainable funds chase past performance. Then, higher flows are experienced within sustainable funds due to either higher marketing efforts or because they are "trendy". But, according to (Das et al. 2018), there seems to be no difference in flows between sustainable and conventional funds in the US.

However, in response to the argument made by (Renneboog, Ter Horst, & Zhang , 2005), (Benson & Humphrey, 2008) find that in the US market, overall, sustainable fund flows are less sensitive to returns than their conventional peers. This last point is confirmed by (Renneboog, Ter Horst, & Zhang, 2008b) who conclude that "money-flows into and out of SRI are less sensitive to negative returns than those of conventional funds".

(Bollen, 2007), based on (Khorana & Servaes, 1999), reports evidence that SRI funds, because they are "trendy", have more money inflows. Moreover, he finds that sustainable investors gain utility from both the performance of a fund, and from consuming the sustainable attribute. As the previous authors, he infers that investors are less likely to withdraw their money from poor performers. In other words, investors in SRI funds can be considered as being more loyal.

Regarding the relation between expenses and performance, for some authors, expenses incurred by SRI could theoretically be higher. (Geczy, Stambaugh, & Levin, 2006) reveal that SRI performance is affected by significant financial costs of imposing SRI constraints on investors. It implies a cost of more than 1.5% per month. This is in line with (Gil-Bazo & Ruiz-Verdu, 2009) who argue that sustainable funds have higher expenses and fees than conventional funds for three reasons: some funds are engaged with company in which they invest to implement sustainable policies, the SRI-screening may be costly, and sustainable investors may be willing to pay a "sustainable premium" for the sustainable characteristics of a fund. However, when looking at their dataset of US equity SRI mutual funds, they found that the expense ratio is not different in sustainable funds and in conventional ones. Moreover, they find no evidence that sustainable funds charge different loads or fees than their counterparts.

Others, like (Renneboog, Ter Horst, & Zhang, 2008a) support evidence that expenses have the same negative influence on sustainable and conventional funds.

In a recent study, (Kiymaz, 2019) contradicted the previous views on the respective expenses of US sustainable and conventional equity funds. He indeed finds that expense ratio has a negative relationship with sustainable mutual fund performance and, to be complete, concludes that age, size, turnover, and loads have a positive relation to sustainable fund performance, so that this conclusion on age contradicts the findings made in the previously above-mentioned studies.

In conclusion, academics find mixed results as to the effect of sustainable mutual fund characteristics. There seems to exist an overall consensus as to the adverse impact of fund age on sustainable mutual fund performance. Regarding the effect of flows, some argue that

sustainable funds have more inflows and that their performance should be less impacted by flows as their investors are more loyal. Lastly, expenses seem to affect negatively sustainable mutual funds.

In this context, we aim to provide new insights as to the effects of sustainable mutual funds characteristics on performance, and to support evidence or to draw new conclusions, based on the existing literature.

2.4 Hypotheses

Based in the aforementioned literature, we enunciate several hypotheses underlying this study.

The main point of this study is about the relation between the size and the performance of sustainable mutual funds. The most recent literature indeed suggests that there is a quadratic relationship between fund size and fund performance.

H_1: Sustainable mutual fund size has a quadratic concave relationship with financial performance.

However, some literature on sustainable mutual funds finds evidence of a positive and linear relationship between size and performance.

H_2: Sustainable mutual fund size has a linear and positive relationship with financial performance.

Finally, some academics, who argue that returns to scale are decreasing within the mutual fund industry, state that there is a negative relationship between size and performance.

H_3: Sustainable mutual fund size has a linear and negative relationship with financial performance.

3. Data and Methodology

This section describes and presents descriptive statistics of the sample used for this research.

3.1 Sample Description

The sample of this study comes from a Morningstar dataset of 2.161 active equity mutual funds domiciled and investing in the US. Morningstar's databases are widely used in scientific literature ((Brown & Goetzmann, 1997), (Almazan, Brown, Carlson, & Chapman, 2004), (Del Guercio & Tkac, 2008), and (Gnabo & Vanhomwegen, 2020).

The sample includes quarterly observations from 2012 to 2018. The sample includes funds that did not survive during the time period, which eliminates potential survivorship bias. As a reminder, the issue with survivorship bias is that the true returns are overestimated because it only contains the returns of the successful funds, or at least those that are currently in existence (Amenc & Martellini, 2004).

Then, we remove from the database the observations with incomplete information on total net assets (TNA), age, net expense ratio (NER), front-end and back-end loads, management fees, returns, sustainability score, and turnover. These screening criteria are in line with (Kacperczy, Sialm, & Zheng, 2005), (Ferreira et al. 2013), and (Kacperczyk, Van Nieuwerburgh , & Veldkamp, 2014).

While the initial sample contains 40.319 observations, we end up with 37.434 observations.

Finally, due to the presence of outliers, we winsorize alphas, net expense ratios, front-end and back-end loads, and flows at the bottom and top 1% level, and age at the bottom and top 3% level (Ferreira et al. 2013).

3.2 Variables: Fund Characteristics

Here, we describe the variables used to determine the performance drivers within sustainable mutual funds. Tables 1, 3 and 4 report descriptive statistics of the sample. Table 2 reports correlations between the variables.

3.2.1 Performance (Net 4-factor alpha)

In this study, risk-adjusted performance is the independent variable. We measure it using the net 4-factor alpha (Carhart, 1997), which is given by:

$$R_{i,t} = \alpha_i + \beta_{0i} RM_t + \beta_{1i} SMB_t + \beta_{2i} HML_t + \beta_{3i} MOM_t + \varepsilon_{i,t}$$

Where,

$R_{i,t}$ is the return in US $ of a fund *i* in excess of the 1-month Treasury bill in month *t*;

RM_t is the excess return in US $ on the market;

SMB_t (small minus big) is the average return on the small capitalization portfolio minus the average return on the large capitalization portfolio;

HML_t (high minus low) is the difference in return between the portfolio with high book-to-market stocks and the portfolio with low book-to-market stocks;

MOM_t (momentum) is the difference in return between the portfolio with the past 12-month winners and the portfolio with the past 12-month losers.

The alphas are already present in the dataset, we do not compute them.

The average fund return is 2.55% quarterly. The fund alphas are, on average, negative with an alpha of -0.37% per quarter. This is consistent with the findings of (Ferreira et al. 2013) who find an average alpha of -0.30% and with the evidence of (Chen et al. 2004), (Malkiel B. , 1995), (Jensen, 1966) and (Gruber, 1996).

In conclusion, in this sample, the average mutual fund is not able to beat the market and exhibits underperformance between 2012 and 2018.

3.2.2 Sustainability Score

In order to assess the determinants of performance for the sustainable mutual funds, we split the database into two sub-groups: conventional funds and sustainable funds. In the sample, each fund has a sustainability score between 0 and 100. The score is provided by Sustainalytics and Morningstar. Firstly, funds are given an ESG rating, based on their investments, from 0 to 100 (for instance, funds that invest in high ESG firms will receive a higher rating). Then, the rating is discounted by a "controversy score" ranging from 0 to 20 related to "bad-ESG" investments. The formula is the following:

$$Sustainability\ score = \sum_{i=1}^{n} w_i(ESG_i - Controversy_i)$$

Where,

ESG_i and $Controversy_i$ are the industry normalized firms' environmental social and governance (ESG) score and the firms' controversy score respectively, and n is the number of assets composing the portfolio and w_i its share.

For example, let's say a mutual fund takes a 50% stake in two companies: one has an ESG score of 80 and a controversy score of 2, while the other one has an ESG score of 40 and a controversy score of 10. Thus, the overall mutual fund sustainability score is:

$$50\% * (80 - 2) + 50\% * (40 - 10) = 54$$

A fund is defined as sustainable (or SRI), following the methodology of (Gnabo & Vanhomwegen, 2020), if it belongs in the top 10% with the highest sustainability score.

Following this methodology, in this sample, the average sustainable fund outperforms the average conventional mutual fund. The average alpha for sustainable funds is -0,09% per quarter, while conventional funds have an alpha of -0,39% per quarter. As a first estimate, US

active equity sustainable mutual funds tend to perform better than conventional funds during the 2012-2018 time period. The difference is statistically significant.

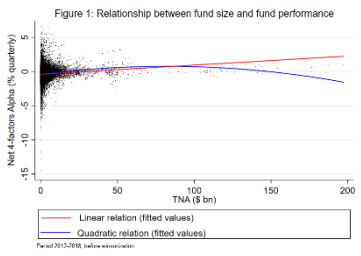
We show in table 4 that, in line with (Bollen, 2007), sustainable mutual funds experience greater money inflows than non-SRI funds. It reinforces evidence that sustainable investors gain utility from investing in mutual funds with sustainable attribute.

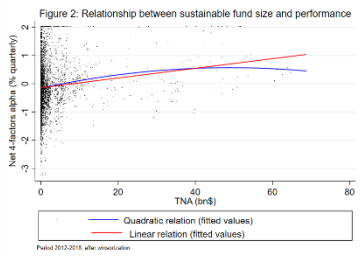
Further, table 4 exhibits that SRI funds tend to be less volatile, on average, than conventional funds. This supports the hypothesis made by (Hartzmark & Sussman, 2019) that high-ESG funds are expected to be lower risk.

3.2.3 Size (TNA)

Fund size is measured by the total net assets (TNA) of a fund in billion US dollars. The average fund size is $2.09 billion. The largest fund of the sample is the "*The Growth Fund of America"* weighting $197.24 billion, while the smallest fund only weights $1.19 million and is a value fund managed by Snow Capital L.P. In this sample, sustainable funds tend to have a larger size, on average, than conventional funds. The average sustainable fund size is $2.48 billion and the average conventional fund size is $2.05 billion. However, while the biggest sustainable fund weights $68.76 billion, the largest conventional fund weights $197.24 billion. Thus, sustainable funds are, on average, statistically larger than conventional funds but in this sample their maximal size is much lower than conventional funds.

Larger funds tend to have statistically higher alphas then smaller funds, with the 10th smallest funds having an average alpha of -0.64% and the 90th largest funds having an average alpha of -0.07%. Figures 1, 2, 3, and table 3 show preliminary evidence of a relation between fund size and performance.





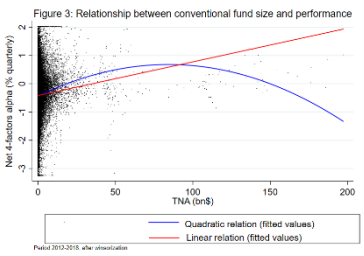


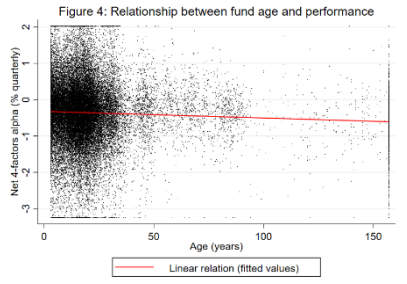
Table 3: Averages for each level size (after winsorization)

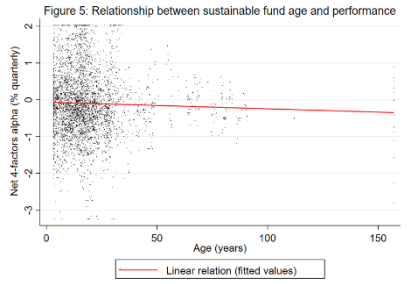
Size percentile	Size	Alpha	Age (years)	NER	Flows	Loads	Management Fees	Turnover	Sustainability Score	Volatility
0 - 10	0.02	-0.64	15.44	0.32	-0.27	0.50	0.82	20.49	45.28	3.48
11 - 20	0.05	-0.50	18.76	0.29	-0.37	0.52	0.79	17.43	45.67	3.44
21 - 30	0.11	-0.42	20.67	0.27	-0.56	0.68	0.74	16.08	45.49	3.32
31 - 40	0.20	-0.39	21.94	0.26	-0.50	0.92	0.71	15.40	45.64	3.31
41 - 50	0.36	-0.39	22.15	0.25	-0.53	1.03	0.71	15.54	45.44	3.37
51 - 60	0.61	-0.35	22.77	0.25	-0.56	1.21	0.68	15.02	45.52	3.41
61 - 70	0.98	-0.35	24.55	0.24	-0.54	1.19	0.65	14.62	45.68	3.30
71 - 80	1.62	-0.28	27.28	0.23	-0.55	1.29	0.63	14.60	45.97	3.32
81 - 90	3.13	-0.25	29.53	0.22	-0.45	1.26	0.60	12.37	45.83	3.27
91 - 100	13.88	-0.07	33.49	0.19	-0.38	1.17	0.53	9.71	46.58	3.13

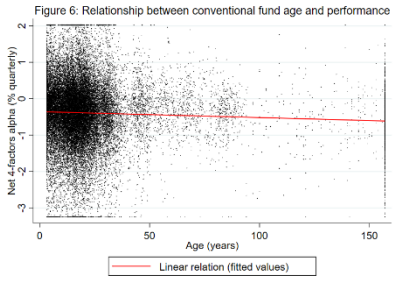
3.2.4 Age

The age of a fund corresponds to its creation date. The average fund age is 23 years old with sustainable funds being younger (19 years) than conventional funds (24 years). This is consistent with findings from (Hartzmark & Sussman, 2019) and (Bauer, Otten, & Koedijk, 2005)

Older funds exhibit a statistically lower alpha, on average, than younger funds, respectively -0.41% and -0.35%. Figures 4, 5, and 6 display early evidence of a negative relation between age and performance.



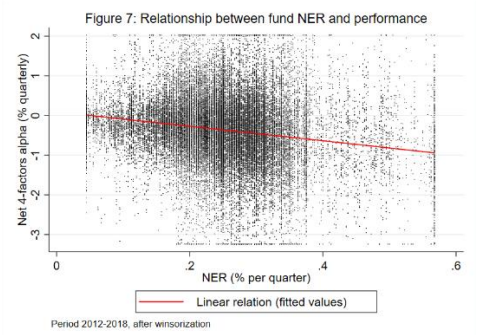




3.2.5 Net expense ratio (NER)

The net expense ratio (NER) is calculated as the total expenses per quarter divided by the TNA. The average net expense ratio is 0.25% per quarter, which is consistent with (Ferreira et al. 2013). On average, there is statistically no difference in the NER between sustainable and conventional funds in this sample.

Funds with lower NER show, on average, a better performance (-0.24%) than funds with higher NER (-0.51%). Figure 7 illustrates this tendency.



3.2.6 Flows

Flows is defined as the percentage growth in TNA from one time period to the previous one, it is:

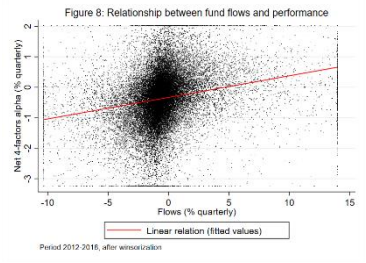
$$Flow_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1} * (1 + R_{i,t})}{TNA_{i,t-1}}$$

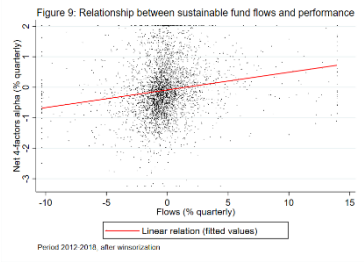
Where,

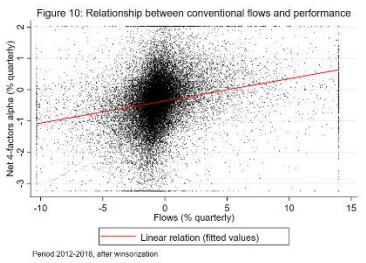
$TNA_{i,t}$ is the TNA of a fund *i* at a time *t*;

$R_{i,t}$ is the return of a fund *i* at a time *t*.

In this sample, funds have an average negative flow of -0.47% per quarter. The average sustainable fund has statistically more flows (-0.17% per quarter) than the average conventional fund (-0.50% per quarter). This is in line with (Hartzmark & Sussman, 2019). From the figures 8, 9, and 10 it seems that flows impact positively the performance.







3.2.7 Loads

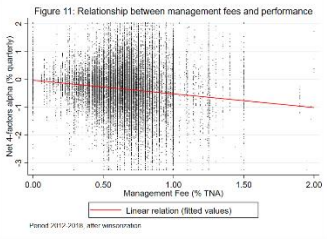
The loads are defined as the sum of front-end and back-end loads. When an individual is willing to invest in a fund that charges front-end fees, it means that an individual has to pay to get shares of the fund. While, if a fund charges back-end fees, it means that an individual has to pay to get out of the fund. Loads should decrease redemption as investors are less inclined to withdraw their money from the fund. In the sample, around 23% of the funds charge loads. The average load is 5.18%[5] without any statistical difference between sustainable and conventional funds. Funds which charge loads yield a lower alpha (-0.44% per quarter) in comparison with those which do not charge loads (-0.34% per quarter). Thus, there seems to exist a negative relation between loads and performance. Moreover, it seems that funds which charge loads

[5] If an investor deposits $100 in a mutual fund which charges 5% front-end load, it means that an investor has to pay $5 to enter into the fund.

have, on average, less flows than those which do not charge loads (-0.64% vs. -0.43% per quarter).

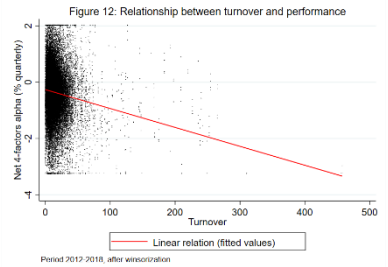
3.2.8 Management Fees

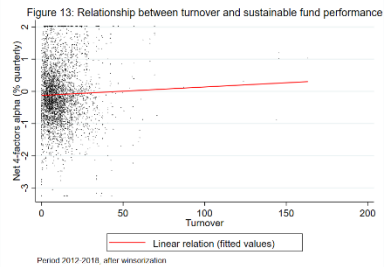
Management fees are considered in this study as a potential proxy for management skills. The average fee is 0.69% per quarter. On average, conventional funds do not charge statistically more or less fees than sustainable ones. As a first estimate, it seems that funds which charge lower management fees have a higher performance (-0.26% per quarter) than those which charge higher fees (-0.46% per quarter). Figure 11 shows that there might exist a negative relation between management fees and performance, but that relation is not clear-cut.

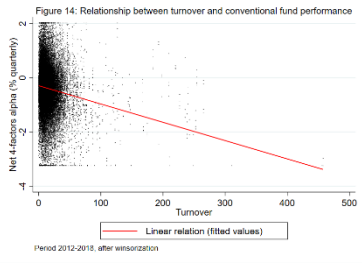


3.2.9 Turnover

The last characteristic is portfolio turnover which is a measure of how active is a fund. It can be seen as a proxy of either an actively or passively managed fund. It represents the average of total acquisitions. In other words, it states how often a fund trades. The average portfolio turnover is 15 per quarter, meaning that, on average a fund acquires 15 stakes in different companies, per quarter. Sustainable funds have, on average, a lower turnover (11 per quarter). Figure 12, 13, and 14 show that there is a concentration of values around 0 and 50 with some outliers which skew the linear relation. Hence, there is potentially no relation between turnover and performance.







4. Empirical Results

This section reviews our results with the aim to identify the determinants of performance within sustainable mutual funds, with an emphasize on the effect of fund size.

We run separate robust Fama-MacBeth regressions to estimate the regression of each cross-section (here, each quarter) and then report the time-series average coefficients (Fama & MacBeth, 1973).

(1) $\alpha_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 SIZE_{i,t}^2 + \beta_3 AGE_{i,t} + \beta_4 FLOWS_{i,t} + \beta_5 NER_{i,t} + \beta_6 LOAD_{i,t} + \beta_7 FEES_{i,t} + \beta_8 TURN_{i,t} + \varepsilon_{i,t}$

Where,

$\alpha_{i,t}$ is the net 4-factor alpha of a fund *i* at time *t*;

$SIZE_{i,t}$ is the logarithm of TNA of a fund *i* at time *t*;

$AGE_{i,t}$ is the logarithm of the age of a fund *i* at time *t*;

$FLOWS_{i,t}$ is the flows of a fund *i* at time *t*;

$NER_{i,t}$ is the NER of a fund *i* at time *t*;

$LOAD_{i,t}$ is the total load of a fund *i* at time *t*;

$FEES_{i,t}$ is the management fees of a fund *i* at time *t*;

$TURN_{i,t}$ is the turnover of a fund *i* at time *t*.

(2) $\alpha_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 SIZE_{i,t}^2 + \beta_3 AGE_{i,t} + \beta_4 FLOWS_{i,t} + \beta_5 NER_{i,t} + \beta_6 LOAD_{i,t} + \beta_7 FEES_{i,t} + \beta_8 TURN_{i,t} + \beta_9 SUST_{i,t} + \varepsilon_{i,t}$

Where,

$SUST_{i,t}$ is the Sustainalytics sustainability score from 0 to 100 of a fund *i* at time *t*.

(3) $\alpha_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 SIZE_{i,t} * SSCORE_{i,t} + \beta_3 SIZE_{i,t}^2 + \beta_4 SIZE_{i,t}^2 * SSCORE_{i,t} + \beta_5 AGE_{i,t} + \beta_6 AGE_{i,t} * SSCORE_{i,t} + \beta_7 FLOWS_{i,t} + \beta_8 FLOWS_{i,t} * SSCORE_{i,t} + \beta_9 NER_{i,t} + \beta_{10} NER_{i,t} * SSCORE_{i,t} + \beta_{11} LOAD_{i,t} + \beta_{12} LOAD_{i,t} * SSCORE_{i,t} + \beta_{13} FEES_{i,t} + \beta_{14} FEES_{i,t} * SSCORE_{i,t} + \beta_{15} TURN_{i,t} + \beta_{16} TURN_{i,t} * SSCORE_{i,t} + \varepsilon_{i,t}$

Where,

$SSCORE_{i,t}$ is a dummy variable which take the value 1 if the fund *i* at time *t* is sustainable and 0 otherwise.

4.1 Determinant of sustainable fund performance

In this section we analyse the determinants of performance: what characteristics influence performance.

Tables 4, 5, and 6 reports the results of the regression analysis.

4.1.1 Fund size

While mutual fund size is one of the most studied variables in academic research, there are no clear-cut results as to the effect of size on performance.

Some authors find a negative relationship between mutual fund size and performance arguing that smaller funds are more flexible, do not suffer from liquidity constraints, or from organisational diseconomies, are better in processing soft information, and have not yet saturated their investment opportunities, in comparison with larger funds.

Others find a positive relationship suggesting that because of economies of scale larger funds incur relatively less expenses than smaller funds, they have more resources for equity research, they are less risky as they are more diversified, and if a fund is large it is partly because it was successful in the past.

Then, more recent research finds evidence of a quadratic relationship. This theory mixes both arguments from the above, arguing that funds have economies of scale up until a certain optimal size, and that past that level, they have diseconomies of scale.

Finally, several authors find no link between fund size and fund performance.

The results of the regressions (1) and (2) show that fund size, on average, is positively related to fund performance in this sample. The coefficient is positive and statistically significant. Thus, larger funds perform better than smaller ones. We find no evidence of a quadratic relationship between size and performance as the coefficient of $(size)^2$ is not statistically significant. This finding is supported by table 3 where there seems to exist a positive linear relationship between size and alpha.

Then, the results of the regression (3) indicate that fund size impacts differently conventional and sustainable mutual funds. We find that size has a positive and statistically significant impact on sustainable fund performance, while that impact is smaller than for a conventional fund.

We can reject H_1 and H_3, and we cannot reject H_2 that states that there is a positive and linear relationship between sustainable mutual fund size and performance.

This implies that there might still exist economies of scale available within the overall US equity mutual funds.

Taking this result into account, we test if economies of scales apply to mutual funds. One would indeed expect that the fund expense ratio would decrease with increasing fund size because many costs associated with funds are not directly proportional to fund size (Tang, Wang, & Xu, 2012). To test for that hypothesis, we run the following Fama-MacBeth regressions:

$$(4)\ NER_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 SIZE_{i,t}^2 + \beta_3 AGE_{i,t} + \beta_4 FLOWS_{i,t} + \varepsilon_{i,t}$$

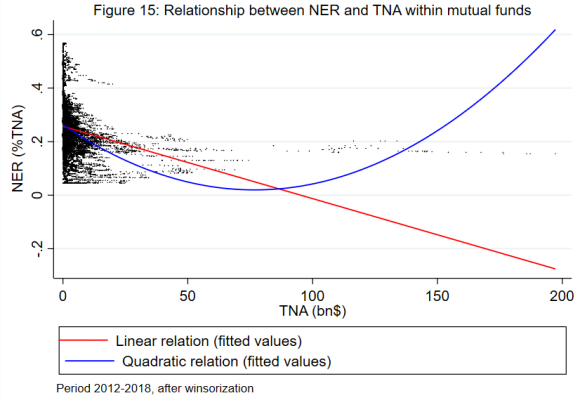
$$(5)\ NER_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 SIZE_{i,t} * SSCORE_{i,t} + \beta_3 SIZE_{i,t}^2 + \beta_4 SIZE_{i,t}^2 * SSCORE_{i,t} + \beta_5 AGE_{i,t} + \beta_6 AGE_{i,t} * SSCORE_{i,t} + \beta_7 FLOWS_{i,t} + \beta_8 FLOWS_{i,t} * SSCORE_{i,t} + \varepsilon_{i,t}$$

Tables 7 and 8 present the results of these regressions. For all funds, the coefficient of size is negative and statistically significant, meaning that there exist economies of scale. The coefficient of $(size)^2$ is positive which indicates that as funds grow their economies of scale tend to be reduced, however, this coefficient is not statistically significant. This is highlighted by figure 15. We can see that past a TNA of ~ $100 bn, net expense ratios tend towards ~ 0.15%.

In other words, there are decreasing economies of scale within US equity mutual funds.

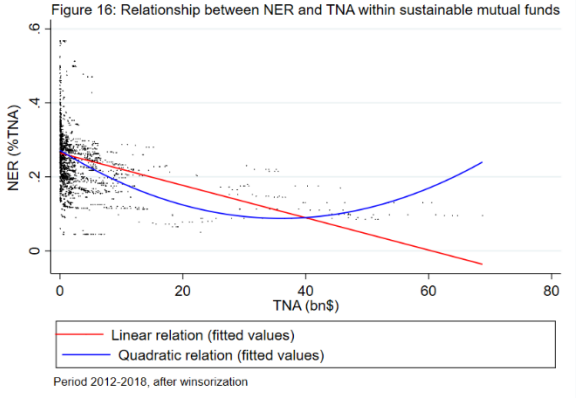
Within sustainable US equity mutual funds, this effect is somewhat different. The fund size coefficient is negative and significant, meaning that there exist economies of scale. The $(size)^2$ coefficient is negative and significant. Consequently, as sustainable funds grow, the scale of economy becomes more important. Figure 16 illustrates that as size increases, NER decreases. We might find such an evidence because the larger sustainable mutual funds have not yet reached the size of larger conventional funds.

Figure 15: Relationship between NER and TNA within mutual funds



Period 2012-2018, after winsorization

Figure 16: Relationship between NER and TNA within sustainable mutual funds



Period 2012-2018, after winsorization

In conclusion, an individual willing to invest in a sustainable mutual fund should invest in larger fund as it will yield, on average, a higher risk-adjusted return (i.e., alpha), all else equal. It is in

line with some academics who argue that larger mutual funds can spread their expenses to a larger asset base.

4.1.2 Age

Fund age provides a measure of a fund's longevity and its managers' ability (Ferreira et al. 2013).

Some authors find evidence that older funds perform better than younger funds because the latter incur start-up and marketing costs, a learning period, and also because younger funds tend to be smaller, hence they are less diversified and bear greater market risk.

On the other hand, some academics state that younger funds are more agile and have to prove themselves as good performers to survive. Hence, yielding a better performance.

Finally, some research finds no evidence of a link between fund age and fund performance.

From regressions (1) and (2), we find evidence of a negative and statistically significant relationship between age and performance. Thus, in this sample, younger funds have a better performance than older ones.

Moreover, from regression (3), we find no statistical difference between sustainable and conventional funds regarding the effect of age on performance.

In conclusion, ceteris paribus, younger sustainable mutual funds should be preferred over older ones in order to have a higher financial performance, on average. Thus, in line with (Otten & Bams, 2002) and (See & Jusoh, 2012), younger sustainable mutual funds are more agile than their more mature peers.

4.1.3 Flows

The smart-money hypothesis states that "investors can detect skilled managers and direct their money to the funds which will produce higher returns" (Gruber, 1996). Thus, active investors would "reallocate their money away from past poor performers and towards past winners, in the expectation that this will increase future returns" (Cuthbertson, Nitzsche, & O'Sullivan, 2010). However, some academics argue that the smart money effect only describes the fact that investors blindly follow past performance or "hot styles" funds, without being able to identify the true top performers.

Overall, with a few exceptions, the literature finds either a positive relation or no relation between fund flows and performance.

From regressions (1) and (2), we show that there is a positive relationship between flows and fund performance. And regression (3), support that there is no difference between sustainable and conventional mutual funds, on average in this sample.

In conclusion, it seems that the smart money effect holds true, in this sample, both for conventional and sustainable funds.

4.1.4 Net expense ratio (NER)

The overall literature on NER states that expenses harm performance. Some argue that it is because it ultimately reduces the shareholders' cash flows, other that mutual funds overinvest in information, or that passively managed funds, which perform better than actively managed ones, incur less expenses.

However, some studies find evidence that higher expenses are compensated by higher returns which are just enough to cover the charges, hence there should be no relation.

Then, some argue that higher expenses yield relatively higher returns.

From regression (1) and (2) we find evidence of a robust and negative influence of NER on fund performance. Regression (3) shows that the effect is the same for sustainable and conventional funds.

In conclusion, our results are consistent with the overall literature which states that expenses negatively affect performance. Thus, on average, sustainable mutual funds with lower expenses perform better than those with higher expenses, all else equal.

4.1.5 Total loads

Funds sometimes charge a load when investors purchase or sell shares of the fund. The main goal of the load is to discourage redemption by making it expensive. Thus, following (Ferreira et al. 2013), and (Chordia, 1996) funds are able to invest in a riskier portfolio to enhance performance. Again, the literature on the matter diverges as to the effect of loads on performance.

We find from regressions (1) and (2) that there exists a negative relationship between loads and performance. Moreover, regarding regression (3), there is no difference between sustainable and conventional funds in this sample of US equity mutual funds.

In line with the descriptive statistics above, we can argue that funds with lower or no loads perform better than their peers. Thus, an individual disposed to invest in a sustainable mutual fund should search for funds that charge no (or low) load.

4.1.6 Management fees

Mutual fund fees can be seen as the "price that uninformed investors pay to managers to invest their money" (Ferreira et al. 2013). This variable may explain that skilled manager would require higher fees than their less-skilled counterparts. However, there is no academic consensus regarding the fact that skilled managers can yield higher returns than their peers.

Some studies highlight the fact that management fees are a cost that ultimately reduces the shareholders' cash flows.

Then, some support the evidence that in general investors overpay managers in regard to their skills. While others suggest that skilled managers are well able to yield a higher performance which more than compensate their higher fees.

Finally, some academics argue that there is no relation between fees and performance.

From regression (1), (2), (3), we find evidence that management fees are statistically insignificant for sustainable and conventional fund performance. Thus, managers who demand higher management fees are either not really skilled or not skilled enough to yield higher returns to compensate for their higher fees.

4.1.7 Turnover

Portfolio turnover is a way to identify if a fund is actively or passively managed. Again, there is no consensus as to the effect of actively or passively managed funds on performance.

Some argue that passively managed funds, as they incur less expenses, should overperform. For instance, passively managed funds have less equity research expenses and less transaction costs.

Others state that actively managed funds are more agile and can adjust to market ups and downs. In the same vein, several studies suggest that some skilled managers are able to yield higher returns because of their strategies but only if they are able to create enough value to cover transaction costs.

Finally, several academics find no evidence of a relation between turnover and performance.

From regression (1), (2), and (3), we show that turnover has a negative influence on fund performance, which is statistically significant. This effect is the same within sustainable and conventional funds. This constitutes an evidence that actively managed funds tend to underperform passively managed funds.

In conclusion, passively managed sustainable mutual funds should be preferred because they yield a higher performance, on average, ceteris paribus.

4.1.8 Sustainability Score

The overall literature finds mixed results in terms of performance differences between conventional and sustainable mutual funds.

We find in the regression (2) that the sustainability score has a significant and positive effect on performance. Furthermore, as shown in table 4, sustainable funds, in this sample, seems to be, on average, larger, younger, with more flows, and with a lower turnover than conventional funds. As explained in detail supra, all these effects have a positive influence on the average performance of these funds.

4.2 Robustness Tests

In this section, we review two tests to assess the robustness of our findings. Firstly, we use false discovery method, derivative of (Barras, Scaillet, & Wermers, 2010), to find potential issues due to the presence of unskilled or lucky funds in the sample. Then, we test for time-dependent results by splitting the sample into two subperiods to find any significant differences.

4.2.1 Testing for False Discoveries

To assess the robustness of the aforementioned empirical results, we test for false discoveries using a method drawn from (Barras, Scaillet, & Wermers, 2010). The method separates funds which are run by truly skilled managers from funds that got lucky or that are average funds.

We divide the sample into three sub-groups: average or unskilled funds, skilled funds, and lucky funds.

A fund is defined as skilled if it belongs to the top 30% of the funds with the highest net 4-factor alpha and to the top 30% with the lowest volatility.

A fund is defined as lucky if it belongs to the top 30% of the funds with the highest net 4-factor alpha and to the top 30% with the highest volatility.

A fund is defined as average or unskilled if it belongs to none of the two above-named categories.

We find that out of the 37.434 initial observations 25.225 (67.38%) are average or unskilled funds, 7.912 (21.13%) are lucky funds, and 4.297 (11.47%) are skilled funds. This is partly in line with (Barras, Scaillet, & Wermers, 2010) who find that on the period 1975-2006 within the US equity mutual funds 75.4% are average, 24% are lucky, and 0.6% are skilled.

Firstly, as stated in the previous section, we find that size is positively linked to performance and that it holds true for both sustainable and conventional funds, while the effect has a lower impact on sustainable funds. Consistent with these findings, table 9 shows that skilled funds are

bigger than other funds. Then, it seems that skilled sustainable funds have a bigger size than their conventional counterparts. This difference is statistically significant.

Secondly, regarding the age of a fund, we suggest that younger US equity mutual fund perform better than older funds. However, it seems that this result is driven by lucky funds which are younger, on average, than skilled funds. The average age of skilled funds is statistically higher for both conventional and sustainable funds. Overall, these results are not consistent with my previous findings. In these sub-samples, older funds seem to perform better than younger ones on average.

Thirdly, we previously support evidence that flows positively impact fund performance. These findings are consistent with table 9. Lucky and skilled funds perform better than average ones, and skilled funds receive, on average, positive flows while it is not the case for lucky funds. These results confirm the smart-money hypothesis and the fact that investors are able to identify skilled funds and to direct their money to them. Moreover, we find that this characteristic influence in the same manner sustainable and conventional funds. This is supported by the fact that the average flow within skilled funds is, on average, not statistically different between sustainable funds and conventional funds.

Fourthly, we find that NER has a strong and negative impact on performance. This is consistent with the results, as skilled funds have a statistically significant lower NER than the other funds.

Fifthly, regarding loads, we find mixed results, which are consistent with previous findings. Skilled conventional funds have statistically lower loads than other conventional funds. Furthermore, between skilled sustainable funds and conventional ones, there is no statistically significant difference in loads.

Sixthly, concerning management fees, both conventional and sustainable skilled funds demand statistically lower management fees than their respective counterparts. This is not in line with our anterior findings as we suggest that management fees have no impact on performance. But the results might have been skewed towards lucky funds which receive the same management fees than average funds.

Seventhly, consistent with our previous findings, we find that both skilled conventional funds and skilled sustainable funds have a statistically lower turnover than their respective counterparts.

Finally, consistent with the previous section, overall skilled funds have a statistically higher sustainable score. Conventional skilled funds have a statistically higher score than their lucky and average counterparts. However, within sustainable funds, there is no difference between skilled, lucky or average funds regarding their sustainable score. Thus, it reinforces the purpose of our study. Indeed, if all sustainable mutual funds are sustainable to the same extent, then an investor should not pick a SRI fund based on its sustainable score but rather on characteristics such as size, age, loads, etc.

In conclusion, our previous findings regarding size, flows, NER, loads, and turnover are consistent with the false discoveries test. However, age and management fees yield different insights. Hence, older funds and with low management fees perform better.

4.2.2 Analysis by Subperiods

According to (Gil-bazo, Ruiz-verdu, & Santos, 2010) and (Rathner, 2013) different sample periods can induce different findings about the performance of sustainable mutual funds in comparison with conventional mutual funds. To assess the degree to which our results are determined by parts of the sample periods, we divide the sample in two subperiods.

The first subperiods covers the first 13 quarters (2012-2015) of the sample, and the second subperiods covers the other 13 (2015-2018).

Table 10 reports the results of this test. Overall, our findings regarding fund size, age, loads, and flows are consistent.

However, during the first subperiod, it seems that net expense ratio is positively and significantly related to fund performance. This is consistent with studies by (Droms & Walker, 1996), and (Ippolito, 1989) who state that funds that spend more money in equity research are able to find good investment opportunities.

Also, regarding turnover, sustainable fund performance seems to be positively impacted by this factor, which induces that actively managed sustainable funds performed better between 2012 and 2015. This might be due to the fact that the period 2012-2015, which follows the 2008 crisis, is more uncertain (we have seen in the literature that turnover might impact positively performance as it allows to adapt to ups and downs of the market) and/or offers more investment opportunities.

Concerning the second subperiod, the only difference is that management fees seem to positively impact the performance of both sustainable and conventional funds. This result is somewhat intriguing as it is contrary to findings from the first set of analyse and from the false discoveries test. We leave that peculiar question to further research.

In conclusion, we may argue that our findings regarding the size, age, loads, and flows are consistent.

4.3 Overview of the Determinants of Performance within Sustainable Mutual Funds

Overview of the determinants impacting sustainable mutual fund performance:

	Descriptive analysis	Regression analysis	False discoveries test	Subperiod analysis
Size	+	+	+	+
Age	-	-	+	+
Flow	+	+	+	+
Net expense ratio	-	-	-	+/-
Loads	-	-	-	-
Management fees	-	**0**	-	**0**/-
Portfolio turnover	**0**	-	-	+/-

All else equal and on average, an individual willing to invest in sustainable mutual funds with the aim to maximise their risk-adjusted return, should search for large passively-managed mutual funds with as few expenses and loads as possible. In addition, funds with high flows should be preferred (even if it might be difficult for individuals to assess fund flow).

There are still uncertainties as to the effect of age on sustainable mutual fund performance.

Comparing our results to the somewhat similar work of (Kiymaz, 2019), we find the same relationships regarding expense ratios and size and their effect on the performance of sustainable mutual funds.

5 Conclusion

This research studies the characteristics of US active equity sustainable mutual fund performance between 2012 and 2018. We find that sustainable mutual funds, on average, outperform conventional mutual funds. There are similar and different determinants of performance between SRI and non-SRI mutual funds.

We find that fund size is positively related to fund performance. Conventional mutual fund experience decreasing economies of scale, while sustainable mutual fund experience increasing economies of scale. We argue that such results are the fact of the larger size of the larger non-SRI funds relative to the larger SRI funds. Moreover, we do not find evidence of a quadratic-concave relationship between size and performance, but rather a linear one.

Then, we find mixed results as to the effect of age on mutual fund performance. Firstly, we suggest that the performance both of SRI and non-SRI mutual funds is affected negatively as they age, supporting that younger funds are more agile and flexible. However, in second instance, we find that this result is potentially skewed by the fact that younger funds are luckier,

hence they bias the overall relation between age and performance. Thus, we are not able to draw clear-cut results as to the effect of maturity on SRI mutual fund performance.

Regarding other characteristics such as flows, loads, expense ratio, management fees, or turnover, we find no difference in their impact on performance between sustainable and conventional mutual funds.

Further, this paper supports the existence of a smart-money effect within sustainable mutual funds, as investors are able to identify top performers. Moreover, investors are shown to detect the truly skilled funds to direct their money towards them, while they are able to find truly unskilled or lucky funds to withdraw their money from them.

Finally, we want to emphasise two important concepts. First, these results hold true for the US mutual fund industry only. As explained by (Ferreira et al. 2013): "Performance of mutual funds depends on the national economies in which the funds operate. This means that the results obtained for instance in samples from the US and the UK cannot be directly extrapolated to other countries." Second, there exists lots of divergent findings within the academic literature on mutual fund performance, and our research is no exception to the rule. (Rathner, 2013) argues that differences in time periods, countries, treatment of survivorship bias, etc. have a strong influence on the findings of a paper. Thus, more studies should be conducted on the matter to reinforce the evidences found in this thesis.

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7 Appendix

Overview of the sustainable finance terminology:

Ethical Investment	Investment philosophy guided by moral values, ethical codes or religious beliefs. Investment decisions include non-economic criteria. This practice has traditionally been associated with negative (or exclusionary) screening.
Values-Driven Screening	Values-based (also referred to as negative or exclusionary) screening is defined as an investment approach that excludes some companies or sectors from the investment universe based on criteria relating to their policies, actions products or services. Investments that do not meet the minimum standards of the screen are not included in the investment portfolio. Criteria may include environmental, social, corporate governance or ethical issues. For example, specific industries or sectors such as weapons manufacturers, or specific companies considered to be poor environmental, social or governance (ESG) executors.
Socially Responsible Investment (SRI)	SRI, as it first emerged, was very similar to ethical investing in that it allowed a level of trade-off between corporate social and financial performance when making investment decisions, and predominantly utilized exclusionary screening. However, modern SRI represents an investment process that seeks to achieve social and environmental objectives alongside financial objectives, utilizing both values-driven, and risk and return screening.
Sustainability	Sustainability or sustainable development refers to the concept of meeting present needs without compromising the ability of future generations to meet their needs. It encompasses social welfare, protection of the environment, efficient use of natural resources and economic well-being.
Risk & Return Screening	Risk and return (or positive) screening is defined as an investment approach that includes non-traditional criteria relating to the policies, actions, products or services of securities issuers. Portfolios are tilted towards stocks that rate well on the nominated criteria, which can include ESG or ethical issues.
Corporate Governance	Procedures and/or processes according to which an organization is directed and controlled. Corporate Governance structure specifies the distribution of rights and responsibilities among the different participants in the organization – such as the board, managers, shareholders and other stakeholders – and lays down the rules and procedures for decision making. National and international best practice standards exist.

Universal Owner	A large asset owner who, as a consequence of its size, owns a slice of the whole economy and market through its portfolios. Universal owners adapt their actions with the intent of improving long-term performance by benefiting the whole economy and market in a logical but ambitious extension of sustainable investing. They justify these actions on financial grounds.
Environmental, Social and Corporate Governance (ESG)	The term that has emerged globally to describe the environmental, social and corporate governance issues that investors are considering in the context of corporate behavior. No definitive list of ESG issues exists, but they typically display one or more of the following characteristics: (i) issues that have traditionally been considered non-financial or not material; (ii) a medium or long-term time horizon; (iii) qualitative objectives that are not readily quantifiable in monetary terms; (iv) externalities not well captured by market mechanisms; (v) a changing regulatory or policy framework; (vi) patterns arising throughout a company's supply chain; and (vii) a public-concern focus.
Best-in-Class Approach	Investment approach that focuses on companies that have historically performed better than their peers within a particular industry or sector on measures of environmental, social and corporate governance issues. This typically involves positive or negative screening or portfolio tilting.
Responsible Investment	The integration of ESG considerations into investment management processes and ownership practices in the belief that these factors can have an impact on financial performance, in particular over the medium to longer-term. Responsible Investing (RI) can be practiced across all asset classes.
Sustainable Investment	Here, we define Sustainable Investment as including all forms of Socially Responsible Investing, ESG-oriented investing. In its most developed form we believe it uses ESG factores in a best in class framework similar to the Responsible Investor definition.

Source: Fulton, M., Kahn, B. M., & Sharples, C. (2012). *Sustainable investing: Establishing long-term value and performance.* Deutsche Bank Climate Change Investment Research.

Table 1: Mutual Fund Descriptive Statistics (after winsorization)

Variable	Mean	S.D.	Minimum	Maximum
Net 4-factors Alpha (% quarterly)	-0.37	0.89	-3.24	2.02
Net return (% quarterly)	2.55	6.07	-43.87	49.18
Standard Deviation (Volatility) (% quarterly)	3.34	1.10	0.83	12.30
Age (years)	23.66	28.63	3.16	157.00
Total Net Asset ($ billion)	2.09	6.81	0.00	197.25
Net Expense Ratio (% quarterly)	0.25	0.09	0.05	0.57
Flow (% TNA)	-0.47	2.98	-10.32	13.97
Total loads (%)	0.98	2.08	0.00	5.75
Management Fees (% TNA)	0.69	0.22	0.00	2.00
Turnover	15.12	16.42	0.00	457.50

Table 2: Correlation

	Net 4-factors Alpha	Age	Total Net Asset (TNA)	Net Expense Ratio (NER)	Flow	Total loads	Management Fees	Turnover	Sustainability Score	Ability
Net 4-factors Alpha	1									
Age	-0.0534	1								
Total Net Asset	0.1623	0.3189	1							
Net Expense Ratio	-0.1781	0.0157	-0.4187	1						
Flow	0.2386	-0.1323	-0.0104	-0.0533	1					
Total loads	-0.0418	0.2011	0.1233	0.3067	-0.0313	1				
Management Fees	-0.1192	-0.0852	-0.3864	0.6254	-0.0474	-0.0113	1			
Turnover	-0.1242	-0.0515	-0.1586	0.0987	-0.0032	-0.0157	0.0605	1		
Sustainability Score	0.1007	-0.0549	0.0068	0.0059	0.0332	0.0103	-0.0122	-0.0765	1	
Ability	0.4126	-0.0631	0.0538	-0.0603	0.1022	-0.0288	-0.0341	-0.0393	0.0349	1

Table 4: Mean differences between conventional and sustainable funds (after winsorization)

Fund Type	Conventional	Sustainable
Size (TNA)	2.05	2.49
Alpha (% quarter)	-0.39	-0.10
Age (years)	27.26	19.11
NER (%TNA)	0.25	0.25
Flows	-0.50	-0.17
Loads	0.97	1.04
Management Fees	0.69	0.68
Turnover	15.54	11.36
Sustainability Score	45.16	50.66
Volatility	3.35	3.17

Table 5: The relationship between mutual fund performance and characteristics

Model	(1)	(2)
Size	0.0553*	0.0541*
Size^2	0.0009	0.0006
Age	-0.036*	-0.034*
Turnover	-0.005*	-0.004*
Flows	0.0646*	0.0644*
NER	-1.12*	-1.15*
Total loads	-0.004*	-0.003*
Mana. Fees	0.0568	0.0473
Sust. Score	*N/A*	0.1443*
Constant	0.2412*	0.2236*
R^2	0.1138	0.1353

** Indicates that the estimated coefficient are statisctically significant at a 5% significance level*

Table 6: The relationship between sustainable and conventional mutual fund performance and characteristics

Model	(3)
Size	0.0519*
Size*SScore	0.0418*
Size^2	0.0001
Size^2*Sscore	-0.0201
Age	-0.0265*
Age*Sscore	0.0424
Flows	0.0645*
Flows*Sscore	0.0068
NER	-1.245*
NER*Sscore	-1.025
Total load	-0.0028
Total load*Sscore	0.0072
Mana. Fees	0.0434
Mana. Fees*Sscore	0.3622
Turnover	-0.0053*
Turnover*Sscore	0.003
Constant	0.2168*
R^2	0.1428

** Indicates that the estimated coefficient are statisctically significant at a 5% significance level*

Table 7: The relationship between size and expense ratio - are there economies of scale?

Model	(4)
Size	-0.0223*
Size^2	0.0002
Age	0.0258*
Flows	-0.0008*
Constant	0.0932*
R^2	0.2145

** Indicates that the estimated coefficient are statisctically significant at a 5% significance level*

Table 8: The relationship between size and expense ratio - are there economies of scale within sustainable funds?

Regression	(5)
Size	-0.0217*
Size*SScore	-0.0038*
Size^2	0.0002*
Size^2*Sscore	-0.0017*
Age	0.0260*
Age*Sscore	0.0010*
Flows	-0.0008*
Flows*Sscore	-0.0003
Constant	0.0923*
R^2	0.2176

** Indicates that the estimated coefficient are statisctically significant at a 5% significance level*

Table 9: Fund characteristics, skills and luck, and performance (after winsorization)

Fund type	All funds	Sustainable funds	Conventional funds
	Average Size (TNA billion $)		
Average funds	1.88	2.02	1.87
Skilled funds	3.43	4.67	3.22
Lucky funds	2.05	2.15	2.04
	Average Age (years)		
Average funds	24.68	18.52	25.29
Skilled funds	26.36	20.97	27.26
Lucky funds	18.93	17.53	19.09
	Average Flows (%TNA)		
Average funds	-0.73	-0.36	-0.76
Skilled funds	0.36	0.41	0.35
Lucky funds	-0.11	-0.10	-0.11
	Average Net Expense Ratio		
Average funds	0.26	0.26	0.26
Skilled funds	0.23	0.23	0.23
Lucky funds	0.25	0.25	0.25
	Average Total Loads (%)		
Average funds	1.02	1.03	1.02
Skilled funds	0.86	1.10	0.82
Lucky funds	0.89	1.04	0.88
	Average Management Fees (%TNA)		
Average funds	0.69	0.69	0.69
Skilled funds	0.66	0.62	0.66
Lucky funds	0.68	0.69	0.68
	Average Turnover		
Average funds	15.71	11.66	16.11
Skilled funds	12.78	9.86	13.27
Lucky funds	14.51	11.71	14.85
	Average Sustainability Score		
Average funds	45.54	50.69	45.03
Skilled funds	46.45	50.64	45.75
Lucky funds	45.84	50.59	45.26

Table 10: Analysis by subperiods

	Panel A (2012-2015)		*Panel B (2015-2018)*		Panel C (2012-2018)	
Size	0.0579	*	0.0461	*	0.0519	*
Size*SScore	0.0157	*	0.0688	*	0.0418	*
Size^2	-0.006		0.001		0.0001	
Size^2*Sscore	0.0044		-0.044		-0.02	
Age	-0.026	*	-0.027		-0.026	*
Age*Sscore	-0.034	*	0.1182		0.0424	
Flows	0.0601	*	0.069	*	0.0645	*
Flows*Sscore	-0.016		0.0298		0.0068	
NER	-1.027	*	-1.46	*	-1.245	*
NER*Sscore	0.539	*	-2.56		-1.025	
Total load	-0.006	*	0.0004		-0.002	
Total load*Sscore	0.0127		0.0024		0.0072	
Mana. Fees	-0.056		0.1441	*	0.0434	
Mana. Fees*Sscore	0.1201		0.6023		0.3622	
Turnover	-0.005	*	-0.004	*	-0.005	*
Turnover*Sscore	0.0112	*	-0.005		0.003	
Constant	0.3061	*	0.1276		0.2168	*
R^2	0.1559		0.1299		0.1428	

** Indicates that the estimated coefficient are statisctically significant at a 5% significance level*